

From the Rhythmicon to the TR-808: *How electronic rhythm reached maturity*

In its April 1987 issue, Popular Mechanics proudly pronounced that "Now, pro and amateur alike have the opportunity to play any musical instrument they wish-regardless of musical training-at the touch of a finger," [1]. For many, the last half century of trials and tribulations with electronic music technology could finally be hailed a success. However, the early visionaries that laid the groundwork for electronic music would have hardly named these words as synonymous with "success." Henry Cowell was one such visionary. His 1930 treatise on "New Musical Resources" was one of the first explorations of how new electronic music technologies might open doors to wholly new realms of composition. "By early 1931, Henry Cowell had been writing complex rhythms in his music for over ten years with little hope hearing them performed accurately [2]." To him, modern advances might finally bring his musical ideas to life. In the following year Cowell commissioned Leon Theremin to prototype the first electronic rhythm machine, the Rhythmicon.

The 1987 article described the success of products that were little more than electronic gadgets. Ironically, it was about that time that Cowell's vision of an electronic rhythm *instrument* finally achieved similar acclaim, in the form of Roland's TR-808. Importantly, the TR-808 was borne not only from the failed ashes of its technological predecessors but also the successes of less ambitious technologies that were similarly hailed in two page spreads of glossy magazines. These transient technologies between the Rhythmicon and modern electronic drum machines all had the potential to push musical boundaries, but instead achieved success as novel gadgetry, accompanying organ sounds in suburban living rooms. Regardless of the musical ambition behind such devices - like the

Chamberlain Rhythmmate or Wurlitzer's Sideman - each new electronic rhythm instrument made important contributions to developing the core attributes of electronic rhythm technology. To finally be considered mature, developers would need endow these machines with a clear musical purpose, an effective interface, and a sonic aesthetic that would be embraced by musicians and the popular culture.

While it has been described as the “prototype for all modern drum machines,” [3] the Rhythmicon hardly garnered any praise when it was debuted at New York's New School for Social Research in 1932. The machine was designed to achieve Cowell's highest musical ambitions. In anticipation of its existence, Cowell invented a system of notation for the instrument and even completed a four movement composition for orchestra and Rhythmicon, *Rhythmicana*. However, Cowell's enthusiastic preparations would prove futile. By 1938 the failure of the Rhythmicon was so complete that Stanford University chose to simply discard one of the two machines in existence – with Cowell's permission to do so. As the “prototype,” the Rhythmicon will serve as an adequate template for analyzing the forthcoming technologies in electronic rhythm. The Rhythmicon failed to achieve a clear musical purpose, it was hindered by a poor interface, and its sonic aesthetic was best described by one San Francisco critic as, “a cross between a grunt and a snort” [4]. However, future instruments would find solutions to each of these problems.

The first Rhythmicon was a large organ-like box with 10 white keys and 8 black keys. It is unclear who deserves credit for the brunt of the technical specifications behind the machine. It is known that Leon Theremin, already famous for the electronic instrument that bears his name, built the machine. It is also known that Henry Cowell commissioned its construction for a mere 200\$. Considering the five figure offers Theremin was receiving from Hollywood to invent new sounds for the silver screen, Theremin was essentially doing the work pro-bono. Cowell boasted the interest of other contemporary composers in the project, such as Nicholas Slominsky and Joseph Schillinger. Theremin

turned to these and other theorists for advice on the machine's construction. Finally, in May of 1932, the Rhythmicon was debuted in New York.

In terms of its musical purpose, Cowell had a clear vision of the Rhythmicon. He had described in *New Musical Resources* the idea of connecting musical intervals to rhythmic ones [5]. For example the 1:1 unison interval might correspond to a $\frac{1}{4}$ note, the perfect fourth to a 3:4 synchopation and the perfect octave to a $\frac{1}{8}$ note. Cowell sought to explore more complex polyrhythms (several rhythmic patterns simultaneously) in his compositions and he used this linkage between intervals and rhythm to do so. Even after the failure of Rhythmicon, Cowell and others continued to pursue polyrhythms. Cowell eventually turned to training musicians to play these sophisticated patterns using standard acoustic instruments. In this way, Rhythmicon had a clear musical purpose. Although one which is nearly unrelated to the way electronic rhythm machines are used today. Later Leland Smith and others would use computers to achieve the musical goals Cowell had set forth. Smith used his computer music program SCORE to recreate the Rhythmicon for the very first performance of Cowell's *Rhythmicana* in 1971 [1]. The Rhythmicon was an inappropriate technology for achieving an otherwise valid musical goal. Unfortunately, this was as detrimental as lacking any clear musical purpose at all.

Rhythmicon was designed with a keyboard style interface similar to a piano's. This design almost certainly stemmed from Cowell's tight linkage between sonic intervals and rhythmic ones. Cowell himself remarked that the complex rhythms he envisioned could have simply been cut on the rolls of a player piano [5]. However, his intention was to offer a greater level of interactivity. Importantly, the Rhythmicon anticipated a fundamental element of modern electronic rhythm interfaces, the separation of gesture and output. As the player held a key, the Rhythmicon would produce a series of tones rather than hold constant with the player's finger. This separation was revolutionary at the time but proved to be too primitive. Cowell complained, "Since there was no way

of giving melodic freedom by varying the note lengths in a single part, and no method of accenting,” that he was still unable to use Rhythmicon to perform many of his experimental works [6]. Critics complained of the Rhythmicon's overtly machine-like monotony. To Cowell, the machine's lack of expressiveness made its interface equal value to the piano roll.

Above all else, the sound of the Rhythmicon drew harsh remarks from critics. Schillinger, who was the sole owner of a Rhythmicon until the 1960's, claimed that the machine could produce tones simulating african drumming. However, critics described its sound as something between rhythmicized grunts and an Indian war whoop [1]. Either way, modern recreations of the machine show that its sound was not very compelling. The tones were produced via the rotation of a wheel, in which concentric rings of holes had been cut. Light passes through the holes, to be detected on the other side by a photosensor. Varying the speed of the turn as well as the position of the sensor along the wheel determined the frequency and timbre of the instrument. A similar design would be used by Hammond in his early organ, with the fundamental addition of controls that could fine tune the timbre of the notes.

With the best intentions and ambition, Cowell and Theremin set out to build a device that would change the way rhythm could be addressed in modern compositions. While their invention was a failure, the Rhythmicon made a lasting contribution to the groundwork of modern electronic rhythm. In the Pollard Syndrum, similar mechanical tones to Rhythmicon's will find a niche within the popular aesthetic. However, the Roland TR-808 will become a case study in the success of an interface that separates gesture from output. However, the issue of a viable musical purpose for electronic rhythm remains unanswered in 1932. Cowell's polyrhythms are still considered experimental even today, and had little influence on progression of electronic rhythm technology.

In 1956 Harry Chamberlain demonstrated the fruits of over six years of basement toiling at the annual trade show of the National Association of Music Merchants. Chamberlain recorded short

segments of acoustic drumming, and his device could play them back at various speeds and permutations. After adding an integrated amplifier and embedding the whole device inside a speaker cabinet he dubbed the machine the Rhythmate. Cowell had turned to technology to achieve a higher musical goal that he felt was unobtainable by alternative means. Chamberlain's device, however, aimed to replace cumbersome acoustic drums and the expertise of drummers. Thus, by design the Rhythmate avoided any problem of musical purpose. It was quite obvious what the machine was used for.

Chamberlain recalls that, “they began to go hear these things and they were so good that [members of the musicians unions] began to get scared...that we would beat all the musicians out of business.” [7]. Unfortunately for drummers, much of popular music of the day incorporated only steady beats and simple time keeping. A tape loop device was the perfect solution to high wages and imperfect playing. Only a short while later, unionists' fears were partially realized. Chamberlain's later devices, the M-1 and M-4, combined tape loops and organ technology to effectively replace entire orchestras with a single instrument. At a cost of \$3,995, studios often turned to the M-1 to “inject their demos with some class” [7] without actually hiring an orchestra. Although the musicians union effectively banned the use of the M-4 and set wage floors on players of Chamberlain's machines or their derivatives, this technology hardly replaced the sounds of the real instruments [7].

What Chamberlain had stumbled upon was an economic need rather than a musical one. If a song lacked sophistication in its rhythm, then the added cost acoustic percussion could be altogether avoided. This is a vital factor in the progression of electronic rhythm. These machines afforded the ability to experiment with music in one's basement or bedroom, meaning that a generation of artists could uncover more progressive genres. As musicians found more sophisticated uses for these new technologies, manufacturers accommodated them with upgraded models. This positive feedback loop drove a generation of musical innovation in hip hop, techno, pop, rock, and virtually every other form of

popular music.

The Rhythmate offered an extremely simple interface that made it easy to use. The machine had fourteen tape loops, each with three tracks. A single tape head, fixed to a slider bar, could be positioned over any of the tapes. Once in position, the tape head could be “fine tuned,” positioning it over or in between tape tracks to blend the various sounds on each tape together. This was done with a single dimensional lever. Tempo, and pitch along with it, could be controlled via rotary knobs. The built in amplifier featured the standard volume, bass, mid, and treble controls. Derivative devices such as the Chamberlain M-1 and the Mellotron would integrate these kind of tape loops into keyboards. Holding down a key ran a tape track to the amplifier. The new tapes featured percussive sounds and even real samples of orchestral instruments. These devices offered no native mechanism to create or record new samples into the tape loops. More experimental users had been known to push the limits of these early drum machines, motivated by the opportunities suggested by an interactive tape loop. For example Don Buchla, who designed several monolithic synthesizers at the same time as Moog, discussed the Chamberlain in an interview “Yes we could [program those], although as I said with some difficulty...you had three tracks...and six locations...I think you had nine seconds or so before it would spring back...so it was quite powerful, with the number of sounds you could put in it.” [8]. Don Buchla's early experiments turning Chamberlain's machines into programmable synthesizers would bear fruit later as digital sampling simplified this process.

The sounds of a Rhythmate were essentially the sounds of the drums recorded in its tape loops. In this way, it was not a strictly electronic rhythm instrument in the same way that the Rhythmicon was. However, encouraged by Chamberlain's success, the Rudolph Wurlitzer Company released the first machine to synthesize drum sounds, the Sideman. Like its predecessors the Sideman was intended to accompany the organ but could be used elsewhere. Wurlitzer saw that the Rhythmate had a successful

combination of purpose and interface, but decided that its success was not married to the recordings on the tape loops. This was convenient since the machine was plagued with reliability issues due to its use of tapes. In addition, Wurlitzer avoided the optoelectronic design of the Rhythmicon, likely because it too was mechanically unreliable and lacked a compelling sound. Instead the Sideman relied on tube circuitry to generate imitation drum sounds like a simple snare drum, a bass, and a cymbal crash. The sounds could be triggered manually or by the use of a sequencing wheel. The Sideman came with 10 preset sequences on the wheel, which could be spin at any speed without affecting pitch.

Wurlitzer's machine was extremely popular. Record producer Hal Davis wrote about the Sideman:

“After plugging it in, I was trying out some of the rhythms before getting ready to resume playing our next set. The others of the group were busy watching while I tried to set it up. Suddenly, I looked up and saw three couples on the dance floor dancing to the rhythm of the Sideman all by itself.” [9]

Having finally uncovered a suitable sonic aesthetic, The Sideman stands as the final “precursor” instrument to modern electronic rhythm technologies.

In 1964, Japanese designer Ikutaru Kakehashi unveiled the R1 Rhythm Ace at the same trade show that had received the Rhythmate eight years earlier. The R1 was essentially a clone of the Sideman, with a very important difference – the R1 was made using transistors. Using solid state technology, Kakehashi was able to massively reduce the cost and size of his drum machine and increase its reliability. The Rhythm Ace and similar solid state devices were so successful that artists began to use electronic rhythm in the recording studio. Robin Gibb of the Bee Gees, Sly and the Family Stone, and JJ Cale are all credited as pioneers of electronic rhythm for their use of drum machines in chart topping recordings. For example, Gibb's 1969 single “Saved by the Bell” incorporates the 'slow rock'

preset of a later version of the Rhythm Ace. Building off of his earlier success, Kakehashi released the TR808, one of the quintessential drum machines of the modern age. By this time, Kakehashi's devices were labeled under his new brand, Roland.

The TR808 brought the evolution of electronic rhythm into the modern age. The TR808 embodied effective alternatives to each of the elements which led to Rhythmicon's failure, a clear musical purpose, a rich interface, and a sonic aesthetic that would be embraced by musicians and listeners alike. The TR808, and later the TR909, not only gave artists the ability to replace conventional drums in their music, but also extend how rhythm is used. The quantized rhythms produced by the machine were essential in beat matching, a practice made popular on the turntables of DJ Cool Herc and others. Furthermore, the machine could generate rhythms endlessly and at high energy. In live performances and dance clubs, rhythm was able to take on a new role as a driving force, unburdened by drummers' fatigue.

The TR808's interface was lean, but very expressive. Artists would select from the 12 preset instruments at the top of the machine. Each were percussive sounds of some kind that could vary in decay, volume, and timbre via a control panel. Using a process called step entry, artists would then associate that instrument with a particular beat in a measure, down to a resolution of $1/8^{\text{th}}$ note triplets. The machine would loop through the single measure, playing each of the associated sounds in sequence. Any beat could be selected as the loop back point, allowing for short fills or unique time signatures. Furthermore, the TR808 could store many of these beat patterns, for use later. Thus, using the TR808 combined preparation with performance. While playing live, artists could fall back on sequences they had stored in the machines memory, modify the acoustics of individual instruments, or sequence entirely new beats on the fly. This unprecedented level of direct interactivity was essential in the progression of electronic rhythm. Like Cowell had envisioned, the TR808 clearly separated gesture

from output. However, unlike the Rhythmicon, the TR808 would continue to sound off even without any gesture at all from the performer. Artists could interact with the machine as much or as little as they needed, allowing them build up persistent rhythms in their performances and move their attention elsewhere. Returning later to the 808, these performers can move the rhythm in a new direction, with no need to skip a beat.

Only 12,000 TR808 sequencers were sold by Roland between 1980-4 [10]. However, over time, the instrument's sonic properties would incubate a cult following. Still today TR808's are constantly traded on the secondhand market. Record producer Ray Keith described the sound of the TR808 kick drum as “like a tidal wave...the sound just travels right through you” [11]. Other instruments on the device were just as unique. The snare drum had an extra “snappy” parameter. The cowbell, although a poor imitation of the real thing, made a popular electronic ping sound. Other included sounds were low mid and high toms, congas, the infamous hand clap, maracas, rimshot, and cymbal.

The TR808 was a pure synthesis instrument, which led many to view it as inferior to digital sample based instruments like the Linn LM-1. However, the 12 preset instruments on the 808 became sought after by a generation of artists seeking a weird electronic alternative to drum machines that held close to the aesthetics of acoustic drums. The TR808 “sound” was captured by the Beastie Boys' breakout album *License to Ill*, and by Marvin Gaye on his hit single *Sexual Healing*. Graham Massey even named his fusion group after the machine, calling it 808State. Even modern hip hop artists like Kanye West pay tribute to the TR808 and its sound. West named his fourth album *808's and Heartbreak*, insisting that the drum machine has a presence on every track (although it is unclear whether this is true).

Roland's cult classic drum machine, the TR808, marks the beginning of maturity for electronic rhythm. Today, drum machines are ubiquitous in nearly all forms of popular music, an achievement

which took nearly fifty years once Cowell and Theremin met massive failure with the Rhythmicon. To reach this stage, designers overcame the shortcomings of the Rhythmicon which can be encapsulated in terms of its musical purpose, its interface, and, of course, its sound. Harry Chamberlin, along with his competitors and organ manufacturers demonstrated that the role of rhythm in much of popular music was one that could be easily filled by technology. Later, the Rhythm Ace cut the ties with acoustic drumming altogether. The Ace proved that electronic percussive sounds had an aesthetic all their own, one that was worthy building the rhythmic foundation behind many hit records. The TR808 finally perfected this sound with electronic voices that had freestanding appeal, despite bearing little similarity to any acoustic instrument (that could have been achieved with digital sampling). More importantly, the TR808 solidified the interface to modern electronic rhythm, step entry. This fundamental approach allowed musicians to give rhythm a new purpose altogether in music, through the persistence of the beats created with it. Furthermore, the direct interactivity of this approach ensured that artists would continue to experiment with the TR808 and similar devices to fully explore and exploit the new sonic space of electronic rhythm.

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